MULTIMEDIA UNIVERSITY

STUDENT IDENTIFICATION NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2016/2017

BBM3034 – BUSINESS MODELLING AND SIMULATION

(All section/Group)

2 MARCH 2017
9.00 am – 11.00 am
(2 hours)

INSTRUCTION TO STUDENT

1. This question paper consists of **FOUR (4)** pages, excluding the cover page, of **FIVE (5)** structured questions.
2. Marks are shown at the end of each question.
3. **Attach your answer in Worksheet 1 to the answer booklet.**
4. Write all your answers in the answer booklet provided.

Answer all questions.

Question One

(a) Discuss the primary usage of modelling and simulation applications. (6 marks)

(b) A system is a collection of entities that act and interact toward the accomplishment of some logical end. Explain with appropriate examples, the difference between a static and a dynamic system. (4 marks)

(c) Briefly explain the procedure of modelling simulation. (6 marks)

(d) In integer programming, what is the purpose of using 0-1 variables, or binary variables? (4 marks)

(Total: 20 marks)

Question Two

A small paper cup manufacturer must meet on time the following demand for its paper cups in 2017: quarter one 3,000 units, quarter two 2,000 units, quarter three 3,000 units and quarter four 4000 units, respectively. Each quarter, up to 2,500 units can be produced with regular-time labour at the cost of RM4 per unit. During each quarter, an unlimited number of units can be produced with overtime labour, at a cost of RM6 per unit. Of all units produced, 10% of defected paper cups is expected and cannot be used to meet demand. At the end of each quarter, 5% of all units on hand are spoilt and cannot be used to meet any future demands. After each quarter's demand is satisfied and spoilt paper cups are accounted for, a cost of RM1.50 per unit in ending inventory is incurred.

Assume x1, x2, x3 and x4 are regular-time production in quarter one, two, three and four respectively. Assume that y1, y2, y3 and y4 are overtime production in quarter one, two, three and four respectively. Assume z1, z2, z3 and z4 are ending inventory in quarter one, two, three and four respectively. There are 1,000 units of usable units available at the beginning of quarter one.

Based on the information above, answer the following questions:-

(a) State the mathematical objective function and constraints to this problem. (6 marks)

(b) Suppose that the manufacturer produces 2,000 units at regular-time production every quarter and produces 1,150 units at overtime production every quarter. Determine the inventory on hand for each quarter. (4 marks)

(c) Based on the units produced in (b), determine the regular-time production cost, overtime production cost, holding cost and total production cost. (4 marks)

(d) Based on the units produced in (b), set up the problem to minimise the total cost of meeting the demand in the next four quarters in **Worksheet 1** (in page 4). **Attach Worksheet 1 to your answer booklet.** (6 marks)

(Total: 20 marks)

Question Three

You are considering investing RM100,000.00 in **three** bonds. The expected annual return, the worst-case annual return and the "duration" of each bond are given in the Table 1 below.

Continued ...

Table 1: Expected Annual Return, Worst-Case Annual Return and Duration

	Bond A	Bond B	Bond C
Expected Return	15%	12%	20%
Worst case Return	10%	8%	7%
Duration (months)	5	6	7

The duration of a bond is a measure of the bond's sensitively to interest rates. For example, if you invest RM25,000 in Bond A and RM30,000 in Bond B, the average duration of the portfolio is [25,000(5) + 30,000 (6)]/100,000 = 3.05 months. You want to maximize the expected annual return from your bond investments, subject to three constraints:-

(i) At most 40% of the total amount to be invested in a single bond.
(ii) The average duration of the portfolio must be at most 8 months.
(iii) The worst-case annual return of the bond portfolio must be at least 50% of expected annual return of the portfolio.

If the ratio of your investment is 4:2:4 for Bond A, B and C, respectively, answer the following questions.

(a) What is the maximum amount you will invest in any one single bond? (2 marks)
(b) What is the amount invested in each bond? (4 marks)
(c) Compute the duration of the portfolio of Bonds A, B, and C. (2 marks)
(d) What is the worst-case annual return and the worst-case annual return constraints for all 3 bonds. (4 marks)
(e) Based on the ratio of your investment, have you satisfied all the constraints of your investment? Explain. (4 marks)
(f) Discuss about the validity of this investment model. (4 marks)

(Total: 20 marks)

Question Four

Company ABC is planning to invest into a new business venture. Based on normally distributed mean and standard deviation, the total profit for Company ABC is the forecasted revenue minus total cost. Total cost of production is the summation of variable cost and fixed cost. Table 2 is the set up of Company ABC's new business venture.

Table 2: Company ABC's Simulated New Business Venture

	A	B	C	D	F	G	H	I
1		Revenue	Variable Cost	Fixed Cost	Profit		Likelihood of losing Money	4.7%
2	Forecast	RM 5,000,000	RM 3,000,000	RM 1,000,000	(a)		Likelihood of Profit > RM1million	50.1%
3	Standard Deviation	RM 500,000	RM 300,000					
4								
5	Simulation	RM 4,762,547	RM 2,830,191	RM 1,000,000	(b)			
6								
7								
8								
9								
10	Iteration							
11	1	RM 932,356						
12	2	RM (21,838)						
13	3	RM 375,090						
14	4	RM 1,806,865						
15	5	RM 964,261						
1008	998	RM 900,091						
1009	999	RM 502,553						
1010	1000	RM 105,518						

Continued ...

Based on the information provided, answer the following questions.

(a) Determine the total profit for Company ABC's new business venture. (2 marks)

(b) Determine the simulated profit of Company ABC's new business venture. (2 marks)

(c) Describe how the 1,000 simulated iteration (trials) are performed in this model using excel. (8 marks)

(d) Explain how the likelihood of losing money of 4.7% is computed using excel. (4 marks)

(e) Interpret the result of likelihood of a profit greater than RM1 million. (4 marks)

(Total: 20 marks)

Question Five

You ran a simple simulation on the annual returns of TM stocks. TM's stock return depends greatly on Malaysia's economic environment, with the probability of 30% high growth, 50% moderate growth and 20% low growth. Initial cash to be invested is RM10,000, with annual additional investment of RM2,000. Table 3 shows your record of probability distribution of TM's return based on each type of economics environment. Table 4 is the 10-year simulated annual return model for TM stock. Probability is randomly generated using normal distribution.

Table 3: Cumulative Probability of Annual Return

Cummulative Return Probability	High growth Rate of Return	Cummulative Return Probability	Moderate growth Rate of Return	Cummulative Return Probability	Low growth Rate of Return
0.05	12%	0.10	12%	0.55	12%
0.10	18%	0.15	18%	0.65	18%
0.20	20%	0.30	20%	0.75	20%
0.25	25%	0.60	25%	0.85	25%
0.35	30%	0.85	30%	0.90	30%
0.45	35%	0.90	35%	0.95	35%

Table 4: Simulated Annual Return

Year	Beginning Cash	Probability	Type of Economic Environment	Annual Rate of Return	Ending cash
1	RM 10,000	0.8335	Low	20%	12,000.00
2	14,000.00	0.4439	Moderate	20%	16,800.00
3	18,800.00	0.1631	High	18%	22,184.00
4	24,184.00	0.7243	Moderate	25%	30,230.00
5	32,230.00	0.4587	Moderate	20%	38,676.00
6	(b)	0.9348	(a)	(a)	(b)
7	(b)	0.1066	(a)	(a)	(b)
8	(b)	0.4459	(a)	(a)	(b)
9	(b)	0.6520	(a)	(a)	(b)
10	(b)	0.0924	(a)	(a)	(b)

Based on all the information provided, answer the following questions.

(a) Determine the types of economic environment and the annual rate of return for Year 6 onwards. (5 marks)

(b) From your answers in (a), compute the Beginning Cash and Ending Cash for Year 6 onwards. (10 marks)

(c) Based on this simulated model, should you invest in TM stock? Explain. (2 marks)

(d) Comment on this simulated investment model. (3 marks)

(Total: 20 marks)

Continued ...

Student ID No :-_____

	A	B	C	D	E	F
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						

End Of Page